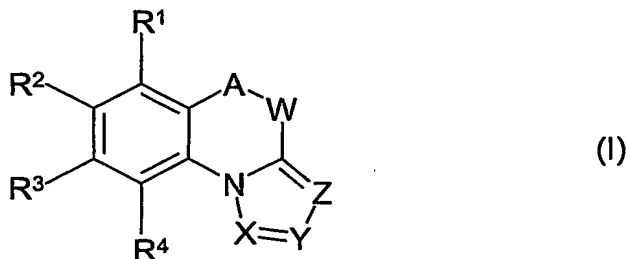


CLAIMS

1. The use of a compound of the formula (I) or a salt thereof:



wherein:

A-W is N=N, N⁺(O⁻)=N or NR⁵-NR⁶, wherein A represents the atom or substituted atom shown on the left side of the groups representing A-W;

X is N or CR⁷;

10 Y is N or CR⁸;

Z is N or CR⁹;

R¹, R², R³ and R⁴ are each independently H, OH, halogen, nitro, cyano, formyl, amino, carbamoyl, CO₂H or sulfamoyl, or benzyl or phenoxy,

15 where each of the latter two radicals is unsubstituted or substituted by one or more radicals selected from the group consisting of (C₁-C₆)alkyl, (C₁-C₆)haloalkyl, halogen, OH, (C₁-C₆)alkoxy, (C₁-C₆)haloalkoxy, (C₁-C₆)alkyl-S(O)_n⁻, nitro, cyano, amino, (C₁-C₆)alkylamino, (C₁-C₆)dialkylamino, (C₁-C₆)alkoxycarbonyl and CO₂H,

20 or are (C₁-C₆)alkyl, (C₂-C₆)alkenyl, (C₂-C₆)alkynyl, (C₃-C₆)cycloalkyl, (C₃-C₆)cycloalkyl-(C₁-C₆)alkyl-, (C₁-C₆)alkoxy, (C₂-C₆)alkenyloxy, (C₂-C₆)alkynyloxy, (C₁-C₆)alkyl-C(=O)O⁻, (C₁-C₆)alkyl-S(O)_n⁻, (C₁-C₆)alkylamino, (C₁-C₆)dialkylamino, (C₁-C₆)alkoxycarbonyl, (C₁-C₆)alkylcarbonyl, (C₁-C₆)alkylcarbamoyl, (C₁-C₆)dialkylcarbamoyl, (C₁-C₆)alkylsulfamoyl or (C₁-C₆)dialkylsulfamoyl,

25 where each of the 18 last-mentioned radicals is unsubstituted or substituted by one or more radicals selected from the group consisting of halogen, OH, (C₁-C₆)alkoxy, (C₁-C₆)alkyl-S(O)_n⁻ and in the case of cyclic radicals also (C₁-C₆)alkyl and (C₁-C₆)haloalkyl;

R^5 and R^6 are each independently H, (C₁-C₆)alkyl, (C₁-C₆)haloalkyl, (C₂-C₆)alkenyl, (C₂-C₆)alkynyl, formyl, (C₁-C₆)alkylcarbonyl, (C₂-C₆)alkenylcarbonyl, COR¹⁰, (C₁-C₆)alkoxycarbonyl, (C₁-C₆)alkyl-SO₂-, (C₁-C₆)alkoxy-(C₁-C₆)alkyl- or R¹⁰;

R^7 , R^8 and R^9 are each independently H, halogen, nitro, cyano, S(O)_nR¹⁰,

5 S(O)_nCH₂CO₂R¹¹, S(O)_nCH₂CO₂N[(C₁-C₆)alkyl]₂, S(O)_nCH₂CONR¹²R¹³, S(O)_nCH₂CONR¹⁴NR¹⁵, formyl, carbamoyl, OH, SH, R¹⁰, NR¹⁶R¹⁷, 1,3-dioxolan-2-yl, (C₁-C₆)alkyl, (C₃-C₆)cycloalkyl, (C₂-C₆)alkenyl, (C₂-C₆)alkynyl, (C₁-C₆)alkoxy, (C₁-C₆)alkyl-S(O)_n-, (C₁-C₆)alkoxycarbonyl, (C₁-C₆)alkylcarbonyl, (C₁-C₆)alkylcarbamoyl or (C₁-C₆)dialkylcarbamoyl, where each of the 10 last-mentioned radicals is

10 unsubstituted or substituted by one or more radicals selected from the group consisting of halogen, OH, (C₁-C₆)alkoxy, (C₁-C₆)alkyl-S(O)_n- and in the case of cyclic radicals also (C₁-C₆)alkyl and (C₁-C₆)haloalkyl;

R¹⁰ is (CH₂)_mphenyl unsubstituted or substituted by one or more radicals selected from the group consisting of halogen, (C₁-C₆)alkyl, (C₁-C₆)haloalkyl, (C₁-C₆)alkoxy,

15 (C₁-C₆)haloalkoxy, nitro, cyano, (C₁-C₆)alkyl-S(O)_n-, (C₁-C₆)haloalkyl-S(O)_n-, amino, (C₁-C₆)alkylamino, (C₁-C₆)dialkylamino, (C₁-C₆)alkylcarbonyl, carbamoyl, (C₁-C₆)alkylcarbamoyl, (C₁-C₆)dialkylcarbamoyl, sulfamoyl, (C₁-C₆)alkylsulfamoyl and (C₁-C₆)dialkylsulfamoyl;

R¹¹ is H or (C₁-C₆)alkyl;

20 R¹² and R¹³, or R¹⁶ and R¹⁷ are each independently H, (C₁-C₆)alkyl or R¹⁰; or R¹² and R¹³, or R¹⁶ and R¹⁷ together with the respective attached N atom form a five- or six-membered saturated ring which optionally contains an additional hetero atom in the ring which is selected from O, S and N, the ring being unsubstituted or substituted by one or more radicals selected from halogen, (C₁-C₆)alkyl and (C₁-C₆)haloalkyl;

25 R¹⁴ and R¹⁵ are each independently H or (C₁-C₆)alkyl;

n is 0, 1 or 2 in each of the occurrences; and

m is 0 or 1;

as a herbicide or plant growth regulator.

30 2. The use as claimed in claim 1 wherein A-W is A-W is N=N, N⁺(O⁻)=N or NH-NH.

3. The use as claimed in claim 1 or 2 wherein R^1 , R^2 , R^3 and R^4 are each independently H, OH, halogen, nitro, cyano, formyl, amino, carbamoyl, CO_2H or sulfamoyl, or benzyl or phenoxy,

where each of the latter two radicals is unsubstituted or substituted by one or more radicals selected from the group consisting of (C₁-C₄)alkyl, (C₁-C₄)haloalkyl, halogen, OH, (C₁-C₄)alkoxy, (C₁-C₄)haloalkoxy, (C₁-C₄)alkyl-S(O)_n⁻, nitro, cyano, amino, (C₁-C₄)alkylamino, (C₁-C₄)dialkylamino, (C₁-C₄)alkoxycarbonyl and CO_2H ,

or are (C₁-C₄)alkyl, (C₂-C₄)alkenyl, (C₂-C₄)alkynyl, (C₃-C₆)cycloalkyl, (C₃-C₆)cycloalkyl-(C₁-C₄)alkyl-, (C₁-C₄)alkoxy, (C₂-C₄)alkenyloxy, (C₂-C₄)alkynyloxy, (C₁-C₄)alkyl-C(=O)O-, (C₁-C₄)alkyl-S(O)_n⁻, (C₁-C₄)alkylamino, (C₁-C₄)dialkylamino, (C₁-C₄)alkoxycarbonyl, (C₁-C₄)alkylcarbonyl, (C₁-C₄)alkylcarbamoyl, (C₁-C₄)dialkylcarbamoyl, (C₁-C₄)alkylsulfamoyl or (C₁-C₄)dialkylsulfamoyl,

where each of the 18 last-mentioned radicals is unsubstituted or substituted by one or more radicals selected from the group consisting of halogen, OH, (C₁-C₄)alkoxy, (C₁-C₄)alkyl-S(O)_n⁻ and in the case of cyclic radicals also (C₁-C₆)alkyl and (C₁-C₆)haloalkyl.

4. The use as claimed in claim 1, 2 or 3 wherein X is N or CR⁷ wherein R⁷ is H, halogen, nitro, cyano, S(O)_nR¹⁰, S(O)_nCH₂CO₂R¹¹, S(O)_nCH₂CONR¹²R¹³, S(O)_nCH₂CONR¹⁴NR¹⁵, formyl, carbamoyl, OH, SH, R¹⁰, NR¹⁶R¹⁷, 1,3-dioxolan-2-yl, (C₁-C₄)alkyl, (C₃-C₆)cycloalkyl, (C₂-C₄)alkenyl, (C₂-C₄)alkynyl, (C₁-C₄)alkoxy, (C₁-C₄)alkyl-S(O)_n⁻, (C₁-C₄)alkoxycarbonyl, (C₁-C₄)alkylcarbonyl, (C₁-C₄)alkylcarbamoyl, (C₁-C₄)dialkylcarbamoyl, where each of the 10 last-mentioned radicals is unsubstituted or substituted by one or more radicals selected from the group consisting of halogen, OH, (C₁-C₄)alkoxy and (C₁-C₄)alkyl-S(O)_n⁻; in which R¹⁰ is (CH₂)_mphenyl unsubstituted or substituted by one or more radicals selected from the group consisting of halogen, (C₁-C₄)alkyl, (C₁-C₄)haloalkyl, (C₁-C₄)alkoxy, (C₁-C₄)haloalkoxy, nitro, cyano, (C₁-C₄)alkyl-S(O)_n⁻, (C₁-C₄)haloalkyl-S(O)_n⁻, amino, (C₁-C₄)alkylamino, (C₁-C₄)dialkylamino, (C₁-C₄)alkylcarbonyl, carbamoyl, (C₁-C₄)alkylcarbamoyl, (C₁-C₄)dialkylcarbamoyl, sulfamoyl, (C₁-C₄)alkylsulfamoyl and (C₁-C₄)dialkylsulfamoyl;

R¹¹ is H or (C₁-C₄)alkyl;

R¹² and R¹³, or R¹⁶ and R¹⁷ are each independently H, (C₁-C₄)alkyl or R¹⁰; or R¹² and R¹³, or R¹⁶ and R¹⁷ together with the respective attached N atom form a five- or six-membered saturated ring which optionally contains an additional hetero atom in the ring which is selected from O, S and N, the ring being unsubstituted or substituted by one or more radicals selected from halogen, (C₁-C₄)alkyl and (C₁-C₄)haloalkyl; and R¹⁴ and R¹⁵ are each independently H or (C₁-C₄)alkyl.

5. The use as claimed in any one of claims 1 to 4 wherein Y and Z are each N.

6. The use as claimed in claim 1 wherein:

A-W is N=N, N⁺(O⁻)=N or NH-NH;

R¹, R², R³ and R⁴ are each independently H, OH, halogen, nitro, cyano, formyl, amino, carbamoyl, CO₂H or sulfamoyl, or benzyl or phenoxy,

where each of the latter two radicals is unsubstituted or substituted by one or more radicals selected from the group consisting of (C₁-C₄)alkyl, (C₁-C₄)haloalkyl, halogen, OH, (C₁-C₄)alkoxy, (C₁-C₄)haloalkoxy, (C₁-C₄)alkyl-S(O)_n-, nitro, cyano, amino, (C₁-C₄)alkylamino, (C₁-C₄)dialkylamino, (C₁-C₄)alkoxycarbonyl and CO₂H,

or are (C₁-C₄)alkyl, (C₂-C₄)alkenyl, (C₂-C₄)alkynyl, (C₃-C₆)cycloalkyl, (C₃-C₆)cycloalkyl-(C₁-C₄)alkyl-, (C₁-C₄)alkoxy, (C₂-C₄)alkenyloxy, (C₂-C₄)alkynyloxy, (C₁-C₄)alkyl-C(=O)O-, (C₁-C₄)alkyl-S(O)_n-, (C₁-C₄)alkylamino, (C₁-C₄)dialkylamino, (C₁-C₄)alkoxycarbonyl, (C₁-C₄)alkylcarbonyl, (C₁-C₄)alkylcarbamoyl, (C₁-C₄)dialkylcarbamoyl, (C₁-C₄)alkylsulfamoyl or (C₁-C₄)dialkylsulfamoyl,

where each of the 18 last-mentioned radicals is unsubstituted or substituted by one or more radicals selected from the group consisting of halogen, OH, (C₁-C₄)alkoxy, (C₁-C₄)alkyl-S(O)_n- and in the case of cyclic radicals also (C₁-C₆)alkyl and (C₁-C₆)haloalkyl;

X is N or CR⁷;

R⁷ is H, (C₁-C₄)alkyl, (C₁-C₄)haloalkyl, (C₂-C₄)alkenyl, (C₂-C₄)alkynyl, (C₁-C₄)alkoxy, (C₁-C₄)haloalkoxy, halogen, nitro, cyano, (C₁-C₄)alkyl-S(O)_n-, (C₁-C₄)haloalkyl-S(O)_n-, S(O)_nR¹⁰, S(O)_nCH₂CO₂R¹¹, S(O)_nCH₂CO₂N[(C₁-C₄)alkyl]₂,

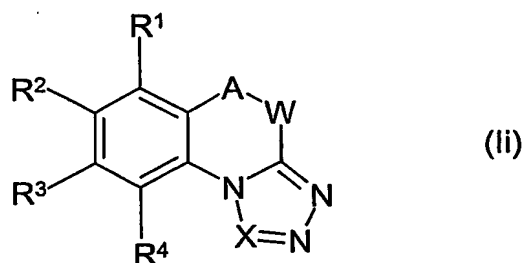
$S(O)_nCH_2CONR^{12}R^{13}$, $S(O)_nCH_2CONR^{14}NR^{15}$, (C₁-C₄)alkoxycarbonyl, formyl, (C₁-C₄)alkylcarbonyl, (C₁-C₄)haloalkylcarbonyl, carbamoyl, (C₁-C₄)alkylcarbamoyl, (C₁-C₄)dialkylcarbamoyl, OH, SH, R¹⁰, NR¹⁶R¹⁷ or 1,3-dioxolan-2-yl; in which

R¹⁰ is (CH₂)_mphenyl unsubstituted or substituted by one or more radicals selected from the group consisting of halogen, (C₁-C₄)alkyl, (C₁-C₄)haloalkyl, (C₁-C₄)alkoxy, (C₁-C₄)haloalkoxy, nitro, cyano, (C₁-C₄)alkyl-S(O)_n⁻, (C₁-C₄)haloalkyl-S(O)_n⁻, amino, (C₁-C₄)alkylamino, (C₁-C₄)dialkylamino, (C₁-C₄)alkylcarbonyl, carbamoyl, (C₁-C₄)alkylcarbamoyl, (C₁-C₄)dialkylcarbamoyl, sulfamoyl, (C₁-C₄)alkylsulfamoyl and (C₁-C₄)dialkylsulfamoyl;

R¹¹ is H or (C₁-C₄)alkyl;

R¹² and R¹³, or R¹⁶ and R¹⁷ are each independently H, (C₁-C₄)alkyl or R¹⁰; or R¹² and R¹³, or R¹⁶ and R¹⁷ together with the respective attached N atom form a five- or six-membered saturated ring which optionally contains an additional hetero atom in the ring which is selected from O, S and N, the ring being unsubstituted or substituted by one or more radicals selected from halogen, (C₁-C₄)alkyl and (C₁-C₄)haloalkyl; and R¹⁴ and R¹⁵ are each independently H or (C₁-C₄)alkyl; and Y and Z are each N.

7. A compound as claimed in claim 1, of formula (li):



wherein:

A-W is N=N, N⁺(O⁻)=N or NH-NH, in which A represents the atom or substituted atom shown on the left side of the groups representing A-W;

X is N or CR⁷;

R¹, R², R³ and R⁴ are each independently H, OH, halogen, nitro, cyano, formyl, amino, carbamoyl, CO₂H or sulfamoyl, or benzyl or phenoxy,

where each of the latter two radicals is unsubstituted or substituted by one or more radicals selected from the group consisting of (C₁-C₆)alkyl, (C₁-

C_6)haloalkyl, halogen, OH, (C_1-C_6) alkoxy, (C_1-C_6) haloalkoxy, (C_1-C_6) alkyl-S(O) $_n$ -, nitro, cyano, amino, (C_1-C_6) alkylamino, (C_1-C_6) dialkylamino, (C_1-C_6) alkoxycarbonyl and CO₂H,

or are (C_1-C_6) alkyl, (C_2-C_6) alkenyl, (C_2-C_6) alkynyl, (C_3-C_6) cycloalkyl, (C_3-C_6) cycloalkyl- (C_1-C_6) alkyl-, (C_1-C_6) alkoxy, (C_2-C_6) alkenyloxy, (C_2-C_6) alkynyloxy, (C_1-C_6) alkyl-C(=O)O-, (C_1-C_6) alkyl-S(O) $_n$ -, (C_1-C_6) alkylamino, (C_1-C_6) dialkylamino, (C_1-C_6) alkoxycarbonyl, (C_1-C_6) alkylcarbonyl, (C_1-C_6) alkylcarbamoyle, (C_1-C_6) dialkylcarbamoyle, (C_1-C_6) alkylsulfamoyle or (C_1-C_6) dialkylsulfamoyle,

where each of the 18 last-mentioned radicals is unsubstituted or substituted by one or more radicals selected from the group consisting of halogen, OH, (C_1-C_6) alkoxy, (C_1-C_6) alkyl-S(O) $_n$ - and in the case of cyclic radicals also (C_1-C_6) alkyl and (C_1-C_6) haloalkyl;

R^7 is H, (C_1-C_6) alkyl, (C_1-C_6) haloalkyl, (C_2-C_6) alkenyl, (C_2-C_6) alkynyl, (C_1-C_6) alkoxy, (C_1-C_6) haloalkoxy, halogen, nitro, cyano, (C_1-C_6) alkyl-S(O) $_n$ -, (C_1-C_6) haloalkyl-S(O) $_n$ -, (C_1-C_6) alkoxycarbonyl, formyl, (C_1-C_6) alkylcarbonyl, (C_1-C_6) haloalkylcarbonyl, carbamoyle, (C_1-C_6) alkylcarbamoyle, (C_1-C_6) dialkylcarbamoyle, NR¹⁶R¹⁷ or 1,3-dioxolan-2-yl; and

R¹⁶ and R¹⁷ are each independently H, (C_1-C_6) alkyl or R¹⁰, wherein R¹⁰ is as defined above; with the exclusion of compounds wherein:

- i) A-W is N=N; R¹, R², R³ and R⁴ are each H; and X is CBr, CSO₂Me, CSMe, CMe or CH;
- ii) A-W is N=N; R¹, R³ and R⁴ are each H; R² is Cl; and X is CH;
- iii) A-W is N=N; R², R³ and R⁴ are each H; R¹ is OH; and X is CH;
- iv) A-W is N⁺(O⁻)=N; R¹, R², R³ and R⁴ are each H; and X is CH;
- v) A-W is NH-NH; R¹, R², R³ and R⁴ are each H; and X is CSMe or CH;
- vi) A-W is NH-NH; R¹, R³ and R⁴ are each H; R² is Me; and X is CH;
- vii) A-W is N=N; R¹, R² and R⁴ are each H; R³ is OMe; and X is N;
- viii) A-W is N=N; R¹, R³ and R⁴ are each H; R² is OMe, Me or H; and X is N;
- ix) A-W is N=N; R¹ and R³ are each H; R² and R⁴ are each Me; and X is N;
- x) A-W is N⁺(O⁻)=N; R¹, R³ and R⁴ are each H; R² is Me or OMe; and X is N;

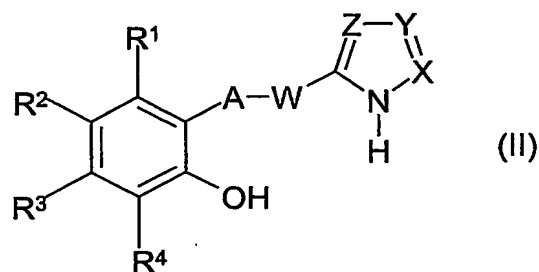
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xi) A-W is $N^+(O^-)=N$; R^1 and R^3 are each H; R^2 and R^4 are each Me; and X is N; and

xii) A-W is NH-NH; R^1 , R^2 , R^3 and R^4 are each H; and X is N.

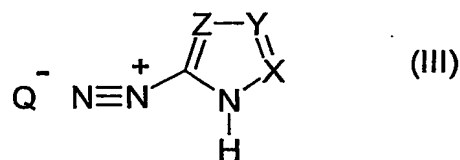
5 8. A process for the preparation of a compound of formula (I), or a salt thereof, as defined in claim 7 which comprises:

a) where A-W is $N=N$ or $N^+(O^-)=N$, cyclodehydrating a compound of formula (II):

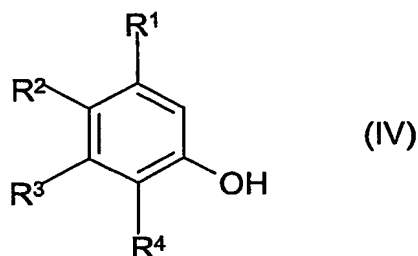


10 wherein A-W is $N=N$ or $N^+(O^-)=N$, and R^1 , R^2 , R^3 , R^4 , X, Y and Z are as defined in formula (I); or

b) where A-W is $N=N$, and the other values are as defined above, coupling a diazonium salt of formula (III):



15 wherein X, Y and Z are as defined in formula (I) and Q is a chloride, sulfate or fluoroborate, with a compound of formula (IV):



20 wherein R^1 , R^2 , R^3 and R^4 are as defined in claim 1, to give an azo intermediate of formula (II) wherein A-W is $N=N$, and the other values are as defined in formula (I), followed by the above described cyclodehydration; or

c) where A-W is $\text{NR}^5\text{-NR}^6$; R^1 , R^2 , R^3 ; R^4 , R^6 , X, Y and Z are as defined in formula (I), and R^5 is as defined in formula (I) with the exclusion of H, reacting the corresponding compound of formula (I) wherein R^5 is H, with a compound of formula (VI):



wherein R^5 is as defined in formula (I) with the exclusion of H, and L is a leaving group; or

d) where A-W is $\text{NR}^5\text{-NR}^6$; R^1 , R^2 , R^3 ; R^4 , R^5 , X, Y and Z are as defined in formula (I), and R^6 is as defined in formula (I) with the exclusion of H, reacting the corresponding compound of formula (I) wherein R^6 is H, with a compound of formula (VII):

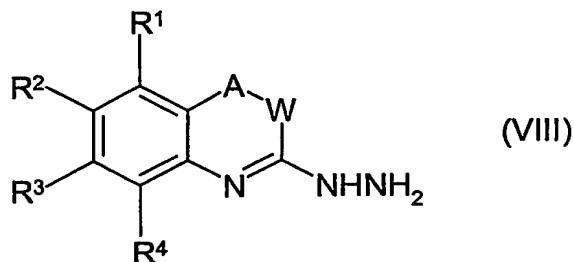


wherein R^6 is as defined in formula (I) with the exclusion of H, and L is a leaving group; or

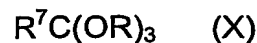
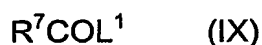
e) where A-W is $\text{NR}^5\text{-NR}^6$, R^5 and R^6 are each H, and the other values are as defined in formula (I), reducing the corresponding compound of formula (I) wherein A-W is N=N or $\text{N}^+(\text{O}^-)=\text{N}$; or

20 f) where A-W is N=N , and the other values are as defined in formula (I), reducing the corresponding compound of formula (I) wherein A-W is $\text{N}^+(\text{O}^-)=\text{N}$; or

25 g) where A-W is N=N or $\text{N}^+(\text{O}^-)=\text{N}$, X is CR^7 , Y and Z are each N, and the other values are as defined in formula (I), reacting a compound of formula (VIII):

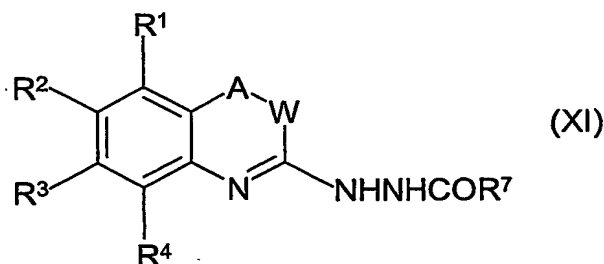


wherein A-W is N=N or N⁺(O⁻)=N, R⁷ is H, (C₁-C₆)alkyl, (C₁-C₆)haloalkyl, (C₂-C₆)alkenyl, (C₂-C₆)alkynyl or R¹⁰, and R¹, R², R³ and R⁴ are as defined in formula (I), with a carboxylic acid or an equivalent thereof of formula (IX) or (X):



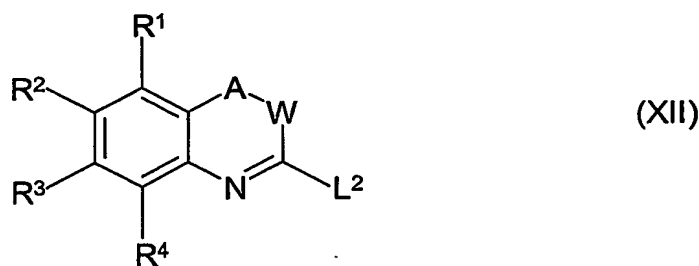
- 5 wherein R⁷ is H, (C₁-C₆)alkyl, (C₁-C₆)haloalkyl, (C₂-C₆)alkenyl, (C₂-C₆)alkynyl or R¹⁰, and L¹ is H or a leaving group; or

h) where A-W is N=N or N⁺(O⁻)=N, X is CR⁷, Y and Z are each N, and the other values are as defined in formula (I), cyclising a compound of formula (XI):



10 wherein A-W is N=N or N⁺(O⁻)=N, R⁷ is H, (C₁-C₆)alkyl, (C₁-C₆)haloalkyl, (C₂-C₆)alkenyl, (C₂-C₆)alkynyl or R¹⁰, and R¹, R², R³ and R⁴ are as defined in formula (I), in the presence of a dehydrating agent or a halogenating agent; or

- 15 i) where A-W is N=N or N⁺(O⁻)=N, and R¹, R², R³ and R⁴ are as defined in formula (I), reacting a compound of formula (XII):



20 wherein A-W is N=N or N⁺(O⁻)=N, R¹, R², R³ and R⁴ are as defined in formula (I), and L² is a leaving group, with a metal azide of formula (XIII):



wherein M is an alkali metal; or

j) where A-W is $N^+(O^-)=N$, and the other values are as defined in formula (I), oxidising the corresponding compound of formula (I) in which A-W is $N=N$.

5 9. A herbicidal or plant growth regulating composition characterised in that it comprises one or more compounds of the formula (I) or salts thereof as defined in any one of claims 1 to 7 and formulation auxiliaries which are customary in crop protection.

10 10. A method of controlling harmful plants or regulating the growth of plants characterised in that it comprises applying an effective amount of one or more compounds of the formula (I) or salts thereof as defined in any one of claims 1 to 7 to the plants to plant seeds or to the area under cultivation.